2nd Grade – Topic Model – Bundle 2
Changes to Land

This is the second bundle of the 2nd Grade Topic Model. Each bundle has connections to the other bundles in the course, as shown in the Course Flowchart.

Bundle 2 Question: This bundle is assembled to address the question of "Why does the land change over time?"

Summary

The bundle organizes performance expectations with a focus on helping students understand changes that occur on and to land. Instruction developed from this bundle should always maintain the three-dimensional nature of the standards, and is not limited to the practices and concepts directly linked with any of the bundle performance expectations.

Connections between bundle DCIs

The idea that maps show where things are located and the shapes and kinds of land and water in any area (ESS2.B as in 2-ESS2-2) can connect to the idea that wind and water can change the shape of the land (ESS2.A as in 2-ESS2-1). The idea that the shape of the land can change connects to the concept that some events happen very quickly and others occur very slowly, over a time period much longer than one can observe (ESS1.C as in 2-ESS1-1). The idea that wind and water can change land can also connect to the idea that different properties are suited to different purposes (PS1.A as in 2-PS1-2 and 2-PS1-3), since water can change some parts of land that wind cannot. The idea that the land can change shape can connect to the idea that a great variety of objects can be built up from a small set of pieces (PS1.A as in 2-PS1-3), since the same pieces of dirt and sand can create different shapes of land.

The engineering design idea that because there is always more than one possible solution to a problem, it is useful to compare and test designs (ETS1.C as in K-2-ETS1-3) can connect to multiple science ideas, such as that wind and water can change the shape of the land (ESS2.A as in 2-ESS2-1) and that some events happen very quickly; others occur very slowly, over a time period much longer than one can observe (ESS1.C as in 2-ESS1-1). The first connection could be made by having students compare a variety of designs that are intended to prevent a river from changing the land of the riverbank. The second connection could be made by having students compare designs intended to prevent danger from a quick event, such as a rock slide.

Bundle Science and Engineering Practices

Instruction leading to this bundle of PEs will help students build toward proficiency in elements of the practices of developing and using models (2-ESS2-2); analyzing and interpreting data (2-PS1-2 and K-2-ETS1-3); and constructing explanations and designing solutions (2-ESS1-1 and 2-ESS2-1). Many other practice elements can be used in instruction.

Bundle Crosscutting Concepts

Instruction leading to this bundle of PEs will help students build toward proficiency in elements of the crosscutting concepts of Patterns (2-ESS2-2); Cause and Effect (2-PS1-2); and Stability and Change (2-ESS1-1 and 2-ESS2-1). Many other crosscutting concepts elements can be used in instruction.

All instruction should be three-dimensional.

Performance Expectations	2-PS1-2. **Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.*** **[Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.]** ***[Assessment Boundary: Assessment of quantitative measurements is limited to length.]*** 2-PS1-3. **Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.** **[Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]**

Performance Expectations (Continued)	2-ESS1-1. **Use information from several sources to provide evidence that Earth events can occur quickly or slowly. [Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.] [*Assessment Boundary: Assessment does not include quantitative measurements of timescales.*]** 2-ESS2-1. **Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.* [Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.]** 2-ESS2-2. **Develop a model to represent the shapes and kinds of land and bodies of water in an area. [*Assessment Boundary: Assessment does not include quantitative scaling in models.*]** K-2-ETS1-3. **Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.**
Example Phenomena	A piece of plastic is good at redirecting the flow of water but a piece of paper is not. Different rivers have different shapes.
Additional Practices Building to the PEs	**Asking Questions and Defining Problems** ● Ask and/or identify questions that can be answered by an investigation. Students *could identify questions that can be answered by an investigation* [about the] ***different purposes*** [for which] ***different properties are suited***. 2-PS1-2 and 2-PS1-3 **Developing and Using Models** ● Develop and/or use a model to represent amounts, relationships, relative scales (bigger, smaller) and/or patterns in the natural and designed world(s). Students could *develop or use a model to represent relative scales* [of events to show that] ***some events happen very quickly and others occur very slowly, over a time period much longer than one can observe***. 2-ESS1-1 **Planning and Carrying Out Investigations** ● Make observations (firsthand or from media) and/or measurements to collect data that can be used to make comparisons. Students could *make measurements* [of different objects that] ***can be built up from*** [the same] ***set of pieces*** *to collect data that can be used to make comparisons*. 2-PS1-3 **Analyzing and Interpreting Data** ● Use and share pictures, drawings, and/or writings of observations. Students could *use and share drawings of observations* [of the effect of] ***wind and water*** [on] ***the shape of the land***. 2-ESS2-1 **Using Mathematical and Computational Thinking** ● Decide when to use qualitative vs. quantitative data. Students could *decide* [whether] *to use qualitative vs. quantitative data* [when investigating whether] ***wind can change the shape of the land***. 2-ESS2-1

Additional Practices Building to the PEs (Continued)	**Constructing Explanations and Designing Solutions** ● Use tools and/or materials to design and/or build a device that solves a specific problem. Students could *use materials to design and build a device that* [uses materials that are best] ***suited to*** [preventing] ***wind from changing the shape of the land.*** 2-PS1-2 and 2-ESS2-1 **Engaging in Argument from Evidence** ● Make a claim about the effectiveness of an object, tool, or solution that is supported by relevant evidence. Students could *make a claim that is supported by relevant evidence about the effectiveness of a* ***map*** [in showing] ***where things are located*** [and] ***the shapes and kinds of land and water in any area***. 2-ESS2-2 **Obtaining, Evaluating, and Communicating Information** ● Obtain information using various texts, text features (e.g., headings, tables of contents, glossaries, electronic menus, icons), and other media that will be useful in answering a scientific question and/or supporting a scientific claim. Students could *obtain information using various texts and text features that will be useful in answering a scientific question* [about] ***events*** [that] ***happen very slowly, over a time period much longer than one can observe***. 2-ESS1-1
Additional Crosscutting Concepts Building to the PEs	**Cause and Effect** ● Simple tests can be designed to gather evidence to support or refute their own ideas about causes. Students could describe how a *simple test could be designed to gather evidence to refute their own ideas about* [how] ***water can*** *cause* ***changes*** [to] ***the shape of the land***. 2-ESS2-1 **Scale, Proportion, and Quantity** ● Relative scales allow objects and events to be compared and described (e.g., bigger and smaller; faster and slower). Students could describe how *relative scales allow objects* [such as the] ***location and shape of land and water*** [on a] ***map*** *to be compared and described*. 2-ESS2-2 **Structure and Function** ● The shape and stability of structures of natural and designed objects are related to their function(s). Students could describe how ***properties*** *and shape of structures of natural and designed objects are related to their functions* [and] ***purposes***. 2-PS1-2
Additional Connections to Nature of Science	**Scientific Investigations Use a Variety of Methods** ● Scientific investigations begin with a question. Students could describe that [their] *investigation* [of whether] ***wind and water can change the shape of the land*** *began with a question*. 2-ESS2-1 **Science is a Way of Knowing** ● Scientific knowledge informs us about the world Students could describe how their *scientific knowledge* [that] ***some*** [Earth] ***events occur very slowly*** *informs* [them] *about the world*. 2-ESS1-1

2-PS1-2 Matter and Its Interactions

Students who demonstrate understanding can:

2-PS1-2. **Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.*** [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.] [*Assessment Boundary: Assessment of quantitative measurements is limited to length.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Analyzing and Interpreting Data
Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.

- Analyze data from tests of an object or tool to determine if it works as intended.

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Different properties are suited to different purposes.

Crosscutting Concepts

Cause and Effect

- Simple tests can be designed to gather evidence to support or refute student ideas about causes.

Connections to Engineering, Technology, and Applications of Science

Influence of Engineering, Technology, and Science, on Society and the Natural World

- Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world.

Observable features of the student performance by the end of the grade:		
1	Organizing data	
	a	Using graphical displays (e.g., pictures, charts, grade-appropriate graphs), students use the given data from tests of different materials to organize those materials by their properties (e.g., strength, flexibility, hardness, texture, ability to absorb).
2	Identifying relationships	
	a	Students describe* relationships between materials and their properties (e.g., metal is strong, paper is absorbent, rocks are hard, sandpaper is rough).
	b	Students identify and describe* relationships between properties of materials and some potential uses purpose (e.g., hardness is good for breaking objects or supporting objects; roughness is good for keeping objects in place; flexibility is good to keep a materials from breaking, but not good for keeping materials rigidly in place).
3	Interpreting data	
	a	Students describe* which properties allow a material to be well suited for a given intended use (e.g., ability to absorb for cleaning up spills, strength for building material, hardness for breaking a nut).
	b	Students use their organized data to support or refute their ideas about which properties of materials allow the object or tool to be best suited for the given intended purpose relative to the other given objects/tools (e.g., students could support the idea that hardness allows a wooden shelf to be better suited for supporting materials placed on it than a sponge would be, based on the patterns relating property to a purpose; students could refute an idea that a thin piece of glass is better suited to be a shelf than a wooden plank would be because it is harder than the wood by using data from tests of hardness and strength to give evidence that the glass is less strong than the wood) .
	c	Students describe* how the given data from the test provided evidence of the suitability of different materials for the intended purpose.

2-PS1-3 Matter and Its Interactions

Students who demonstrate understanding can:

2-PS1-3. **Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.** [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Make observations (firsthand or from media) to construct an evidence-based account for natural phenomena.

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Different properties are suited to different purposes.
- A great variety of objects can be built up from a small set of pieces.

Crosscutting Concepts

Energy and Matter

- Objects may break into smaller pieces and be put together into larger pieces, or change shapes.

Observable features of the student performance by the end of the grade:		
1	Articulating the explanation of phenomena	
	a	Students articulate a statement that relates the given phenomenon to a scientific idea, including that an object made of a small set of pieces can be disassembled and made into a new object.
	b	Students use evidence and reasoning to construct an evidence-based account of the phenomenon.
2	Evidence	
	a	Students describe* evidence from observations (firsthand or from media), including:
		i. The characteristics (e.g., size, shape, arrangement of parts) of the original object.
		ii. That the original object was disassembled into pieces.
		iii. That the pieces were reassembled into a new object or objects.
		iv. The characteristics (e.g., size, shape, arrangement of parts) of the new object or objects.
3	Reasoning	
	a	Students use reasoning to connect the evidence to support an explanation. Students describe* a chain of reasoning that includes:
		i. The original object was disassembled into its pieces and is reassembled into a new object or objects.
		ii. Many different objects can be built from the same set of pieces.
		iii. Compared to the original object, the new object or objects can have different characteristics, even though they were made of the same set of pieces.

2-ESS1-1 Earth's Place in the Universe

Students who demonstrate understanding can:

2-ESS1-1. **Use information from several sources to provide evidence that Earth events can occur quickly or slowly.** [Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.] [*Assessment Boundary: Assessment does not include quantitative measurements of timescales.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Make observations from several sources to construct an evidence-based account for natural phenomena.

Disciplinary Core Ideas

ESS1.C: The History of Planet Earth

- Some events happen very quickly; others occur very slowly, over a time period much longer than one can observe.

Crosscutting Concepts

Stability and Change

- Things may change slowly or rapidly.

Observable features of the student performance by the end of the grade:		
1	Articulating the explanation of phenomena	
	a	Students articulate a statement that relates the given phenomenon to a scientific idea, including that Earth events can occur very quickly or very slowly.
	b	Students use evidence and reasoning to construct an evidence-based account of the phenomenon.
2	Evidence	
	a	Students describe* the evidence from observations (firsthand or from media; e.g., books, videos, pictures, historical photos), including:
		i. That some Earth events occur quickly (e.g., the occurrence of flood, severe storm, volcanic eruption, earthquake, landslides, erosion of soil).
		ii. That some Earth events occur slowly.
		iii. Some results of Earth events that occur quickly.
		iv. Some results of Earth events that occur very slowly (e.g., erosion of rocks, weathering of rocks).
		v. The relative amount of time it takes for the given Earth events to occur (e.g., slowly, quickly, hours, days, years).
	b	Students make observations using at least three sources
3	Reasoning	
	a	Students use reasoning to logically connect the evidence to construct an evidence-based account. Students describe* their reasoning, including:
		i. In some cases, Earth events and the resulting changes can be directly observed; therefore those events must occur rapidly.
		ii. In other cases, the resulting changes of Earth events can be observed only after long periods of time; therefore these Earth events occur slowly, and change happens over a time period that is much longer than one can observe.

2-ESS2-1 Earth's Systems

Students who demonstrate understanding can:

2-ESS2-1. **Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.*** [Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena and designing solutions.

- Compare multiple solutions to a problem.

Disciplinary Core Ideas

ESS2.A: Earth Materials and Systems

- Wind and water can change the shape of the land.

ETS1.C: Optimizing the Design Solution

- Because there is always more than one possible solution to a problem, it is useful to compare and test designs. *(secondary)*

Crosscutting Concepts

Stability and Change

- Things may change slowly or rapidly.

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Connections to Engineering, Technology, and Applications of Science

Influence of Engineering, Technology, and Science on Society and the Natural World

- Developing and using technology has impacts on the natural world.

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Connections to Nature of Science

Science Addresses Questions About the Natural and Material World

- Scientists study the natural and material world.

Observable features of the student performance by the end of the grade:		
1	Using scientific knowledge to generate design solutions	
	a	Students describe* the given problem, which includes the idea that wind or water can change the shape of the land by washing away soil or sand.
	b	Students describe* at least two given solutions in terms of how they slow or prevent wind or water from changing the shape of the land.
2	Describing* specific features of the design solution, including quantification where appropriate	
	a	Students describe* the specific expected or required features for the solutions that would solve the given problem, including:
		i. Slowing or preventing wind or water from washing away soil or sand.
		ii. Addressing problems created by both slow and rapid changes in the environment (such as many mild rainstorms or a severe storm and flood).
3	Evaluating potential solutions	
	a	Students evaluate each given solution against the desired features to determine and describe* whether and how well the features are met by each solution.
	b	Using their evaluation, students compare the given solutions to each other.

2-ESS2-2 Earth's Systems

Students who demonstrate understanding can:

2-ESS2-2. **Develop a model to represent the shapes and kinds of land and bodies of water in an area.** [*Assessment Boundary: Assessment does not include quantitative scaling in models.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Developing and Using Models
Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions.

- Develop a model to represent patterns in the natural world.

Disciplinary Core Ideas

ESS2.B: Plate Tectonics and Large-Scale System Interactions

- Maps show where things are located. One can map the shapes and kinds of land and water in any area.

Crosscutting Concepts

Patterns

- Patterns in the natural world can be observed.

Observable features of the student performance by the end of the grade:		
1	Components of the model	
	a	Students develop a model (i.e., a map) that identifies the relevant components, including components that represent both land and bodies of water in an area.
2	Relationships	
	a	In the model, students identify and describe* relationships between components using a representation of the specific shapes and kinds of land (e.g., playground, park, hill) and specific bodies of water (e.g., creek, ocean, lake, river) within a given area.
	b	Students use the model to describe* the patterns of water and land in a given area (e.g., an area may have many small bodies of water; an area may have many different kinds of land that come in different shapes).
3	Connections	
	a	Students describe* that because they can map the shapes and kinds of land and water in any area, maps can be used to represent many different types of areas.

K-2-ETS1-3 Engineering Design

Students who demonstrate understanding can:

K-2-ETS1-3. **Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.**

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. • Analyze data from tests of an object or tool to determine if it works as intended.	**ETS1.C: Optimizing the Design Solution** • Because there is always more than one possible solution to a problem, it is useful to compare and test designs.	

Observable features of the student performance by the end of the grade:		
1	Organizing data	
	a	With guidance, students use graphical displays (e.g., tables, pictographs, line plots) to organize given data from tests of two objects, including data about the features and relative performance of each solution.
2	Identifying relationships	
	a	Students use their organization of the data to find patterns in the data, including:
		i. How each of the objects performed, relative to:
		1. The other object.
		2. The intended performance.
		ii. How various features (e.g., shape, thickness) of the objects relate to their performance (e.g., speed, strength).
3	Interpreting data	
	a	Students use the patterns they found in object performance to describe*:
		i. The way (e.g., physical process, qualities of the solution) each object will solve the problem.
		ii. The strengths and weaknesses of each design.
		iii. Which object is better suited to the desired function, if both solve the problem.